TRACK TECHNIQUE

The Journal of Technical Track & Field Athletics

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from the desk of fred wilt

What type of material is desired for publication in TRACK TECHNIQUE? Who are the prospective authors from whom material should be forthcoming? What procedure should be followed in submitting material for publication? After manuscripts are submitted, when will they be published? Answers to these questions are of interest in guiding prospective TRACK TECHNIQUE authors upon the proper course of action.

Manuscripts on any aspect of track and field athletics, and related areas of knowledge such as physiology, psychology, mechanics, and sports medicine are welcomed. All types of articles - practical, theoretical, technical, scientific, empirical, philosophical, inspirational - are suitable.

It is common knowledge that each person is better informed and more knowledgable than any other on certain, specific matters which affect him personally. There are, therefore, a great number of prospective TRACK TECHNIQUE authors among athletes, coaches, specialists in areas of knowledge related to athletics, readers of TRACK TECHNIQUE, and others closely associated with the sport. It is no exaggeration that each and every coach and athlete may well be the world's leading authority on some specific point or phase of athletics, regardless of how great or small, obvious or obscure. Prospective authors need not necessarily be well-known authorities. The quality of material submitted is the criterion by which manuscripts are evaluated for publication.

As coaching gains status as a profession, so will writing and publishing gain importance as documentary evidence of achievement, ability, and professional prestige. Indeed, the day may well be at hand when writing by coaches will be considered with the same emphasis that writing and publishing by academic professors is now regarded by university administrations: "Publish or perish." Among coaches of the recent past, the feeling often prevailed that there was insufficient time for writing, since coaching kept them fully occupied. This, of course, was utter nonsense. More progressive coaches today take the same advice toward time available for writing that they so freely give their athletes regarding the time factor in training: The "also-ran" can put forth an infinite number of apparently legitimate excuses as to why he cannot find time to train properly - whereas the "champion", beset with the same demands upon his time, somehow 'creates' and finds whatever time is necessary to get the job done properly in terms of training to achieve the success he deserves for his effort.

For addditional information on length, how to prepare manuscripts, temureration, etc., write the editor at 2540 Edgelea, Lafayette, Indiana.

Track Technique

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How They Train

by Fred Wilt

L. JAY SILVESTER, Bear River (Utah) High School, Utah State University, and U. S. Army. Age,24 years.

BEST MARKS: Discus, 199'2½" (60.72m)(world record). Shot, 61'5¼" (18.73m). Javelin, 200'(60.96m). 100 yards, 10.4; 220 yards, 24.5; 440 yards, 60. Best standing throws: Discus, 161'(49.07). Shot 54'1"(16.48m). Best practice throws: Discus, 204'(62.18m). Shot, 61'7", (18.77m).

BORN: August 27, 1937 at Plymouth, Utah; 6'2½" (1.89m) tall; 230 lbs. (105kg);started athletics in 1952 at age 14.

Athletic Progress:

Year	Age	3 lbs. 9 oz. (1.64kg) Discus		12 lbs. (5.45kg) Shot	
1952	14	105'	(32m)	40'	(12.19m)
1953	15	133'7"	(40.71m)	45'7"	(13.89m)
1954	16	148'10"	(45.36m)	52'0"	(15.85m)
1955	17	170'4½"	(51.93m)	58'3 7/8"	(17.78m)
		4 lb.6½ ozs. (2kg)		16 lbs. Shot (7.257kg)	
1956	18	157'10"	(48.11m)	52'6"	(16m)
1957	19	172'4½"	(52.64m)	55'6"	(16.91m)
1958	20	181'8"	(55.37m)	57'½"	(17.38m)
1959	21	184'0"	(56.08m)	57'4"	(17.47m)
1960	22	190'11"	(58.19m)	60'9¾"	(18.53m)
1961	23	199'2½"	(60.96m)	61'5¼"	(18.73m)

Competitive season starts in late January with indoor shot competition. Discus competition begins in March and ends in early September. After two months of rest from training, the pre-competitive training period starts in approximately December. Throws in 20-30 competitions annually.

WEIGHT-TRAINING: December to March: Monday, Wednesday, and Friday, approximately 90 minutes each workout. Three to 7 minutes recovery between following sets, depending upon personal inclination. Each session approximately as follows:

(1) Warmup with clean and presses, 10 x 150 lbs (68kg).

(2) Bench-press. (a) 10 x 225 lbs. (b) 8-9 x 275 lbs. (125kg) (c) 3-6 x 300 lbs. (136kg) (d) 10 x 250 lbs. (113kg). (He has only 300 lbs. (136kg) of weights available - otherwise would bench-press more). Best bench-press is 341 lbs. (155kg) in Poland during 1961.

(3) Squat-jumps with weights on shoulders. (a) 10 x 175 lbs. (80 kg) (b) 10 x 195 lbs. (88kg) (c) 10 x 215 lbs. (100kg).

(4) Lateral-raises, lying on back on bench, arms extended at side to floor, lifting to perpendicular position and return, weight in each hand, with arms straight. (a) 10 x 25 lbs. (13.6kg) (b) 8 x 35 lbs. (16kg) (c) 5-6 x 40 lbs.

(5) Dumbell curl and press with each hand. (a) 5 x 65 lbs. (30kg) (b) 5 x 75 lbs (34kg) (c) 5 x 80 lbs. (36kg) (d) 3 x 100 lbs. (45kg).

Weight-training during competitive season: Monday and Wednesday only. Each workout identical to weight-training sessions during pre-competitive period.

Competition warm-up: Jog 440 yards. 10 pushups. 15-20 side-straddle hops. 10 x touching each toe with hands, while standing with legs crossed. 3-5 discus throws, the first easy, and the remainder at full effort. Rest 5 minutes and compete.

Pre-training warm-up: prior to throwing: Jog 440-880 yards. 25 butterfly sit-ups, with legs spread, alternately touching toes of foot with opposite hand. Sprint 250 yards. Jog 100 yards. Then directly into shot-putting, followed by discus throwing.

Pre-competitive season training: Weight-training Monday, Wednesday, and Friday (as

above). Throwing as follows on Tuesdays, Thursdays, and sometimes Sundays. Two standing puts with the shot of 50' - 53'. (15.24m-16.15m) Then 15 - 30 puts with the shot, starting near 57' (17.37m) (when in good form), and attempting to exceed 60' (19.29m), making each put with maximum effort. Directly thereafter, start discus throwing. 5-6 standing throws of 135' - 155' (41.18-47.24) with discus. Then throwing from the circle for a full hour or more, taking one throw each 3-5 minutes (15-30 throws total), using only one discus, walking to retrieve discus between throws. Each throw is at maximum effort. In 1961 he seldom threw under 170' (51.81) during pre-competitive season training. He spends 2-3 hours total at each of these workouts. (On 11-23-61 he threw for the first time since 9-9-61, and hit 178' the first throw, 185' the second throw, and had a best of 186' that day. He also put the shot 56' (17.07m) that day.)

Competitive season training: Monday and Wednesday, weight-training (above). Throwing and putting on Tuesday and Thursday similar to that during pre-competitive training (above), except that the discus throws are seldom under 180'. These workouts also take 2-3 hours.

Personal opinion of best features of technique: "Hard drive or push-off from rear of circle, and delivery action in the discus. I don't have one best feature in shot techniques."

Personal opinion of worst features of technique: "In the discus I take too long first step, use too much of the circle, thus fouling. In the shot I arrive at the throwing position too upright, and step in the bucket."

Personal opinion of the six most important points to master in discus technique:

1. Start with discus as far to the rear as possible.
2. Drive off the left foot in turning - dont't just float.
3. Land with right foot in center of circle on the line of direction of throw - not to the right or left.
4. Land in center of circle with discus still trailing behind as far as possible - don't let it drift forward.
5. Left foot must land on line of direction of throw - not to right or left (in the bucket).
6. Delivery action must be explosive, up, and out, without too much scooping action of the arm.

Personal opinion of value of standing throws (and puts): Worthless. Good for nothing except warm-up and elaxing between throws in competition.

Silvester was coached by Durrell Hughes from 1952 through 1955, and by Ralph B. Maughan from 1956 through 1959. He has been self-coached since 1960.

On 9-9-61 at East Los Angeles (California) Junior College Silvester threw the discus 210' 2" (64.06m) on a field which sloped 27" (.68m), thus rendering unofficial the longest throw in history.

Statement required by the act of August 24, 1912, as amended by the acts of March 3, 1933, July 2, 1946 and June 11, 1960 (74 Stat. 208) showing the ownership, management and circulation of TrackTechnique, published quarterly at Los Altos, Calif., for September, 30, 1961.

1. The names and addresses of the publisher, editor and managing editor are: Bert Nelson and Cordner Nelson, publishers, and Hal Bateman, managing editor, all of Box 296, Los Altos, Cal. and Fred Wilt, editor, 2540 Edgelea, Lafayette, Indiana.
2. The owner is Track & Field News, Inc., Box 296, Los Altos, Calif. Stockholders holding more than 1% of the stock are Bert, Linda, Cordner, Elizabeth, Rebecca, and Nancy Nelson, all c/o Box 296, Los Altos, Calif.
3. The known bondholders, mortgagees and other security holders owning or holding 1% or more of the total amount of bonds, mortgages or other securities are: none.
4. The average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the 12 months preceding the date shown above was 612. (signed) Bert Nelson. Sworn and subscribed before me this 18th day of October, 1961. (signed) Marie J. Loach (my commission expires June 5, 1963.)

Four or Five Hammer Turns?

by E. Sjutsch, Master of Sport at the Institute of Physical Culture, Lvov, USSR

Recently there have been many experiments by athletes and coaches to improve hammer throwing technique through the introduction of a fourth turn. Especially has this been true among throwers of short height and light weight. One of these has been the Soviet ex-recordholder, Stanislav Nyenashev, who has reached 212'3½" (64.71m) through use of this unusual technique.

By increasing the number of turns, the thrower is able to give the hammer greater acceleration and increase his potential.

I am interested in this problem, and have experimented with it for a number of years. Measurement with a dynamometer placed between handle and ball of hammer revealed that the hammer reaches its highest speed between the fourth and sixth turns. Throws made using four turns produced results two to four meters better than throws with three turns, but not without certain disadvantage. Even the throwers with the best technique and sense of balance find it difficult to use four turns and still remain within the circle.

One prominent hammer coach from the Soviet Union, the former champion and recordholder, A. J. Schechtel, sought the solution to this problem. He was able to show that the thrower who can "heel and ball" forward in his turns across the circle in a curved line (rather than a straight line) can give the hammer additional acceleration. But to deviate slightly to the left side, the thrower must give the hammer-head another low point. The low-point should remain to the right (for the right-handed thrower), because the hammer has a tendency to overtake the thrower. The thrower must resist this tendency and keep the low point to the right so the hammer-head will not overtake him.

By the use of a technique involving four turns I have achieve better results than every before in competition. However, all my throws are invalid, as I fouled the throwing circle. This was unfortunate, and it became necessary to seek a method whereby four (or more) turns could be employed and still remain in the circle after delivery.

Four heel and ball turns across the circle leaves too little space to properly execute the fourth turn and delivery. By turning on the ball (only) of the left foot (for the right-hand thrower) during the fourth turn, fouling can be avoided. However, this is - done at the expense of great difficulty in retaining balance at the conclusion of the fourth turn where speed is at its greatest. Furthermore, this did not permit the thrower to take full advantage of all his leg-strength in delivery. Thus the problem at this point was how to control the high speed of the hammer which is developed by using four turns?

Turning on the ball of the foot takes up much less space in the circle than the conventional heel and ball turn. However, the ball-turn could not be utilized instead of a heel and ball turn for the fourth turn. Consequently, the next problem was where to use the ball-turn? Where would the ball-turn be less likely to interrupt the balance, continuity, and rhythm of the total movement? Should it be inserted at the start, middle, or finish?

After much experimentation, it became obvious that it would be necessary to start with ball turns before moving across the circle with the three conventional heel and ball turns, so as not to interfere with the rhythm of the final heel and toe turns. During five turns, using two ball-turns at the start, plus the three conventional heel and ball turns which followed.

The technique of throwing the hammer with five turns is as follows:

The first two turns (for the right handed thrower) are performed on the ball of the left foot in one spot, and the following three turns are the orthodox heel and ball turns. Thus the first two ball turns serve the preliminary swings of the hammer and give the thrower the same advantage as the flying start gives the sprinter (greater initial momentum).

I have succeeded in throwing over the 60 meters mark with this technique. Athletes and coaches will be pleased to learn that consitent good results may be reached in a relatively short time (one or two months), and the hammer will travel two to four meters farther.

(Reprinted from "Soviet Sport," No. 109, 1960, published in Moscow, Russia)

Isometric Exercises and Their Value to the Athlete

by Professor A.W. Willee

A muscle may be made to work in different ways. If the muscle contracts so that its two insertions approach one another, the muscle is said to be working concentrically, the muscle can be seen to shorten and thicken and this type of contraction is called insotonic. Thus if a barbell is taken in hand and the weight carried up towards the shoulder by bending the elbows, the muscles which flex the fore-arms are working isotonically to move a constant weight.

If the weight is now lowered through the same path, the same muscles are "paying out" against the force of gravity and are said to be working eccentrically, and the insertions are being drawn apart and the muscle is seen to get longer and less bulky. If the same muscles support the weight in one position, say with the forearms parallel to the ground, they are under tension, but there is no movement, the muscles are therefore said to be working isometrically or statically.

If the same muscles were made to work against an external force greater than themselves, which straightened the arm, they would then be said to perform a negative contraction.

It has long been established that a muscle will increase in size and strength only if it is required to exert force against a greater resistance than it has done before. This is known as the principle of overload. How the principle of overload should best be applied-through isotonic, isometric or negative contractions - has been the subject of investigations in recent years.

In 1953 two German investigators, Drs. Hettinger and Muller, published the results of their investigations on nine subjects who trained muscles in 71 different ways. They concluded that for strength increase, isometric contractions were the most valuable, and that the tenion should be 66% of the maximum, held for 6 secs. and that once per day was adequate.

Several investigators sought to verify the conclusions of Hettinger and Muller. In 1956 an account of an experiment at the State University of Iowa was published showing that static muscle contractions of six seconds duration caused significant gains in strength. The experiment did not seek to compare the merits of isometric and other forms of work. In 1957 an experiment was reported from America in which the investigators showed that isometric type contraction resulted in greater strength gains than isotonic work.

Early in 1958 an investigator at the University of Copenhagen reported that as a result of his investigations, one isometric maximum contraction per day had no statistically significant training effect, that muscle strength is apt to increase with an increasing number of contractions per day and that "it cannot be said whether isometric or dynamic training should be used, nor how often and how intensively it is necessary to train a muscle to get best results, and it cannot be said if negative contractions under maximum circumstances are more effective than maximum isometric contractions". At about the same time an investigation was reported from New Zealand, which suggested that no significant increase in strength results from one 66% isometric daily contraction, but that muscular endurance does improve.

Dr. Karpovich, at the 1958 annual meeting of the American Academy of Physical Education, reported an experiement being conducted in Connecticut by M. Asa, under the direction of Dr. W. T. Liberson, which showed that single isometric contractions caused 155% strength increase and isotonic contraction 108%, while 20 isometric contractions gave an increase of 297%. In each case the exercise was given daily. Information as to the length of the experiment is not available, but one muscle very little used in ordinary life - abductor digiti quinti - was the subject matter for the experiment.

The available evidence is obviously conflicting. This may be due to the use of different techniques of testing, to the testing of different types of strength, to variations in psychological physiological factors, to the fact that men's muscles answer better to training than women's do, or to other unknown factors. In the Copenhagen experiment the trained muscles were tested every 9 days. This in itself would act as a training stimulus, especially as the maximum of five seconds each was taken as the measure. The importance for the trainee in sports and athletics is, however, obvious. It can be concluded that daily isometric contractions of six seconds duration at 66% or above of maximum do in fact have a training effect, and that this effect will be

greater for men than women, and that the effect will vary from individual to individual; strength too, it should be noted, varies in an individual at different times in the day.

Isotonic work with weights, used progressively, does lead not only to increase in muscular strength, muscular endurance, and muscular power, but also to increased heart and lung efficiency. However, this type of training needs to be done three times a week for an hour or more to be effective. It is very fatiguing and the organism needs rest between training sessions. Thus when the athlete approaches his final training period and the competitive season, he can spare neither the energy nor the time for intensive weight training. He must devote his time and energies to skill and tactical training. At this time then, he may well substitue isometric work for isotonic work and whether he limits himself to one or ten or twenty daily isometric contractions, he will certainly maintain and develop the strength he has built up with weights, and this part of his training will occupy little time, little space, little or no apparatus and will certainly not be tiring.

Isometric contractions can be performed by using one part of the body as a resistance against which another works, for example, for strengthening the chest muscles, place palms of the hands together and push them together as hard as possible, or for shoulder retractors, join the hands and try to pull them apart. A piece of rope, the wall, the bend in the garage, any immovable object, provides opportunities for the understanding and ingenious trainee to arrange that those muscle groups he requires to strengthen are put under maximum tension. In practice it is convenient to work for a maximum contraction, and not to try to estimate or measure 66% of maximum.

Strength is an important factor in the performance of all motor skills, but strength alone does not give skill. Other aspects of training for a specific event must not be neglected.

Muscles contain a number of fibres, the number is decided before birth for each individual and it is thought to be impossible to increase their numbers. Explanation of observable increase in muscle bulk as a result of training is that we can improve the size and quality of existing fibres. Through hard usage the wall of each fibre becomes thicker and tougher - the tough joint from your butcher inevitably comes from a hard-working animal. Not only do fibrea grow - especially if before training they have been little used-but new blood vessels develop in an active muscle. The bigger fibres, more capillaries and increased amount of connective tissue resulting from heavy exercise add bulk and weight to the muscle. New blood vessels develop mostly through long sustained activities; connective tissue, bigger fibres, thicker lining through heavy, fast moving activities.

When a muscle is required for use in lifting a light object, only parts of the muscle are brought into play and the number of units used varies according to the effort required. If we attempted to lift a small suitcase which we though to be empty, but which was in fact full of lead, the case would fly up in our hand at the first attempt far higher than we intended. If a light effort is continued over a long period, then the units of the muscle take part at any one time, and only a near maximum effort calls all units into play at one time. It is probable that some muscle fibres are rarely used in everyday life.

The parable of the talents, observations and experiment tells us that the muscles develop through use and tend to lose efficiency through disuse. Only if muscles are called upon to do more than they have been required to do previously do they grow stronger. This is known as 'overload'. The amount of work done in a given time is the important factor in strength development. The truth of this can be observed by comparing the strong bulky muscles of the sprinter with the long, lean ones of the distance runner. The concert violinist moves his arm, holding a light bow, thousands of times daily without fatigue, but he does not develop huge muscles.

Applying our knowledge of the above to the use of progressive resistance exercise we arrive at the following:

1. To develop strength - therefore bulk and weight - very heavy weights must be used. Since the weights are heavy, the number of lifts will be few. Muscular strength may be defined as that quality which enables a heavy load to be moved with a single effort.

2. To develop muscular endurance, more repetitions and more sets would be required, and the weights would therefore have to be lighter. Muscular endurance is shown in the ability to perform sub-maximal efforts for a long period without the working muscles becoming tired.

3. To develop power, a procedure similar to that for the development of muscular en-

durance would be required, with greater emphasis on the speed of performance. Muscular power is the explosive effort required, for example, by the shot putter, discus thrower, or high jumper. Each of these types of training will develop heart and lung efficiency, essential for activities such as distance running.

For weight reduction, many repetitions with light weights, performed at high speed and continuously for as long as possible would be the answer.

In all types of training the overload principle must be applied by a combination of increasing weight and an increasing number of repetitions. For example, if a given weight can be managed for a certain number of times, then as progress is made the trainee arrives at the stage where each set can be performed several more times. Weight is then added and the repetitions revert to the original number. This process continues until the limit is reached or the objective of the training is achieved.

I think all athletic people have now come to accept weight training as an essential part of any program they have designed in order to employ all their physical capabilities in their particular pastime. Indeed, to achieve physical fitness for any reason, the use of weight exercises is probably the surest and quickest method.

Naturally, every type of athletic movement differs in some way. Consequently, when considering a training program the correct muscle functions must be closely examined in order to obtain suitable exercises that will help the desired action. Thus a part of the training must be 'specialized'. However, it must be remembered that every athletic action comes as a result of co-ordinated muscle effort (some muscles of course play a greater part than others but the majority of the body's muscular structure is used in each action) and, in this specialized training, emphasis must be placed on co-ordination.

When considering track and field competition, two completely different classes of sporting actions immediately spring to mind. Some events are of an endurance nature while the others are of an explosive type. Therefore, in their training, the athletes who specialize in the endurance events should have a program that accentuates the long repetition-low-weight routine. Conversely, the 'explosive' athletes should concentrate more on the heavier weights. Naturally, this is over simplyfying their schedules to an almost misleading extent but it does give a general indication of their needs. But, all athletes do have some basic requirements.

For example, every athlete should exercise his abdominal muscles. The importance of these muscles in any sports action cannot be too highly stressed. Fundamentally, the strong abdominal muscles are essential in any sport but, another important reason for the exercising of this region is that this exercise will massage the abdominal organs. As these organs provide essential supplies for body health any poor functioning of their duties usually results in some form of ill-health. Certainly the body will not feel fit.

A word of warning. A weight training schedule should be suggested by an expert as it should be balanced according to the athlete's needs. If this is not done some exercises may not have the desired benefits.

One basic rule regarding the mechanics of exercises is that at all times maximum contraction and extension should be sought. (Otherwise restricted muscle action may occur).

Finally, a thought about track and field. In my opinion the athlete, when seeking expert coaching advice, should be already fit. Modern coaches are usually specialized and so can describe and seek a certain action from their pupils. They will want certain muscles to be stronger in certain action from their pupils. They will seek the maximum muscle efficiency by the athlete in the action that is regarded as perfect to obtain best results. In this matter close co-operation between the coaches, with their excellent knowledge of the desired movements, and physical educationists, with their knowledge of the best training to strengthen and co-ordinate the muscles, should surely be vital. Closer co-operation between the gentlemen that operate in these two fields will probably markedly increase in the next few years in athletics. I hope so. athletics. I hope so.

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(2) C. P. Wolbers & F.D. Skills - "Development of Strength in High School Boys of Static Muscle Contractions". - Research quarterly - Vol. 28, No. 1 - 15-19.
(3) D.R. Mathews & R. Kreese - "Effects of Isometric & Isotonic Exercises on

Distance Running in Hot Weather

by John Sterner

The effects of extremely hot weather on distance running performance do not seem to be fully understood by most athletes and coaches. These effects, while debilitating to a degree in most track events, never become serious except in the longer running events such as six miles and up.

However, the collapse of such trained athletes as Max Truex, Bob Soth, and Hubert Parnakivi in the Russia - U.S.A. meet at Philadelphia in 1959 and the even more extreme case of Jim Peters in the Empire Games marathon in Vancouver several years ago, to name but a few, indicates that the subject deserves discussion.

It may be asked why, in the same race, one runner may go into a state of complete collapse requiring hospitalization and another go on to finish without the slightest distress. Obviously there is some extreme difference in the reactions of the two men to the stress of hot weather competition. It may be remarked that such collapse almost never occurs except in hot weather and usually under conditions of high humidity.

If we accept the fact that runners such as the competitiors in the 10,000 meters in the Russia-U.S.A. meet, Gordon Pirie in his collapse while leading the field in the final lap of the British championship 6 miles some years ago, and Peters in the marathon were well trained athletes, then we have to ask why these men fell by the wayside while others were able to go on with no ill effects whatever.

In planning a four mile road race in New York City recently, during a period in which temperatures had been hovering in the nineties, AAU officials were reportedly worried about the competitiors in the veterans division of the run (over 45) and the possible harmful effects upon them. In this race, which was run in three sections, open, junior (under nineteen) and

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Book Review

BETTER ATHLETICS THROUGH WEIGHT TRAINING

By Bob Hoffman. Published by Strength and Health Publishing Co., York, Penn. 1959. pp 400

Since 1923 Bob Hoffman, U.S. Olympic weight lifting coach, has been battling for universal acceptance of weight lifting as a part of all training. After reading this highly interesting book you will be convinced that all but the uninformed are using weight training, regardless of their chosen field of athletic endeavor. The number of athletes giving testimonials as to the value of weight lifting in this book is overwhelming evidence that author Hoffman has got his point across.

Elbow Flexor Muscle Groups". - Research Quarterly - Vol. 28, No. 1 - 26-37.
(4) Petersen,
(4) F.B. Petersen - "Muscle Training" - FIEP Bulletin No. 1, 1958 - 15-19.
(5) J. Wallace - "The Development of Muscular Endurance through Isotonic & Isometric Exercise" - No. 2. J. of P.E. - No. 14 - April, 1958.
(6) Unpublished report from Dr. Karpovich to the Author.
(Reprinted from the October, 1958 issue of Track and Field, published in Melbourne, Australia).

Professor A. W. Willee is a Senior Lecturer in Physical Education, at the University of Melbourne in Australia

veterans, four of the athletes in the junior division collapsed at the finish line, one seriously enough to be taken to a hospital, while all the men in the veterans race finished the run in excellent condition. This must not be considered unusual since marathon runners know that it is extremely rare for an older runner to collapse after a run. There seems to be a definite resistance to the effects of heat in runners over the age of thirty. The reasons for this are not known but it will be enough if an effort can be made to point out means of preventing this kind of collapse.

Since all competitors in a race endure the same weather conditions and since it has been pointed out that physical condition does not seem to prevent collapse, the reason must lie elsewhere.

Men have endured temperatures under test conditions far higher than any encountered in nature, so it may be said that one of the major reasons for collapse under such conditions is not heat but the combinations of heat and dehydration. Unfortunately, while the effects of heat on athletic competition are easily felt, those of dehydration produce few symptons until it is too late. Reports from runners who have collapsed in races show that in most cases they felt no particular stress until the last. In extreme dehydration, no thirst may be felt. This is one of the most dangerous aspects of the whole problem, since at the moment the athlete most needs water he is not thirsty.

Many athletes, particularly marathon runners, have reported weight losses during competition of up to ten pounds. Since a fluid loss of over five percent of body weight leads to physical deterioration accompanied by loss of judgement and perception, these men are nearing the danger point. It must be remembered that the competition itself may not be the only means of dehydration since many athletes eat and drink sparingly on the day of a meet and may therefore, after standing around several hours under a hot sun in a sweat suit made for cold weather warmups, be slightly dehydrated before the competition begins. Water loss may be more than a quart an hour in hot weather.

As the body continues to lose water the blood becomes thicker and more viscous. The circulation slows down and the heart must work harder. As the loss passes ten percent the slower circulation no longer is sufficient to carry the body heat to the skin surface where it can be dissipated. The body temperature suddenly rises and collapse or death follows. It would seem that the usual practice of taking salt tablets might even increase the danger since this type of collapse is not caused by salt depletion but by lack of water. The addition of salt to the body fluids would increase the body's need for water.
The danger of salt depletion in a trained athlete is minor compared to that of dehydration.

The body acclimates itself to hot weather competition but only if training is carried out in the hottest part of the day. One cannot acclimate himself to running in hot weather by training early in the morning or in the cool of the evening when the actual race is to be run at midday.

In order to avoid the possibility of dehydration, the intake of water must not be sparing since the athletes' thirst is not a reliable index of his need for water under conditions of high heat and humidity. It has been shown that a man will usually drink only enough liquid at first to make up approximately half of his loss. Therefore it seems reasonable that a person who is suffering from dehydration should drink more than merely enough to quench his thirst. The danger is not from drinking too much, but from drinking too little.

Some runners have complained of nausea brought on by drinking of fluids before or during competition but most long distance runners who have trained much in hot weather experience no difficulty. It seems likely that an athlete can accustom himself to the intake of generous quantities of water during or before competition with no difficult if he does so in training. At worst it would seem better to risk a little nausea rather than the possiblity of collapse.

References:

Scientific American, Vol. 201, No. 6 Dec., 1959, p. 140.
M.D., Medical Newsmagazine, Vol. 4, No. 9, Sept. 1960, p. 192.

by John Sterner
New York, New York

(John Sterner has raced and studied training methods in both Sweden and Finland. He has been a successful marathon performer since 1946).

The Minimum Requirement

by Brian Mitchell, BRITISH AAA SENIOR HONORARY COACH

"Now bid me run,
and I will strive with things impossible;
yea; get the better of them."

Within the number of people who do any proper running at all, the following types might be noticed: casual, apparently casual, dedicated, supposedly dedicated, genuine and humbug. Each type offers a varying measure of reliability, potentiality and actual achievement. There is, conceivably, a level of "striving" against which every athlete can be measured, and this measurement (one of the jobs, and one of the main interests, of a coach) tells us quite a bit about the man himself, as well as about his ability as an athlete. We can see, among the types listed above, numberless recipes tending to produce and prevent the successful making of a champion; setting aside for a moment pure physical gifts, I should like to look at the runners we have all known, and to locate in them, this vital element, the ability to strive.

The man who said the words quoted above was sick. It is well known, that sick people will often fight very hard to dominate their sickness, and from them the athlete might learn a lot. Some go under easily. Yet, a year or so ago, in Britain, a 10 year old girl was awarded a badge, because she has to lie face down for most of the day, every day of the week, since she was crippled by polio. I daresay that the world could afford too many other examples of this kind of courage, for this girl stays cheerful; that she manages by striving, to do so, must put to shame and flight many an athlete who will not train because it is cold, or will not try because it hurts. "Striving" postulates some kind of conflict, whether of spending your life face down, or saving your energy feet up. Winning such a conflict is often not so very difficult, yet the casual athlete often does not think it worth while, the supposedly dedicated one cannot bring himself to (though he tries to get everybody else to think he can), and the pure humbug talks about it, imagines it and even goes through the motions in public. Just as sickness will sometimes win hands down, so will disease of character-weakness, self-deception, or shallow-colossus.

Then, among those people who voluntarily adopt running as a sport, and apart from those older ones who merely "run because they like it, through the broad, bright land," there will be a fair percentage who know, positively or negatively, about "striving." (Even the non-combatant, too old or too young, can try, and often do - as Cerutty says, Elliott may run faster, but not necessarily harder). These men have to face the problem both immediately, that is, before and during training or competition; and protractedly, that is, throughout months and years of rise and fall, encouragement and disappointment. The business usually goes on for a long time, so that it is not surprising when very few stick it out. A few such as Bannister or Davis, will prove themselves quite quickly, and retire knowing that they can do it; but most have to go on for a long time, not being sure where their threshold is.

In practical terms, some men strive to train hard but cannot fight an opponent; some will tackle any opposition but will not discipline themselves to train; occasionally the two are put together. Whatever measure of either aspect a particular athlete displays, we can be sure that he will know at least where his weakness is, though he will often not admit it, and it may take an observant coach some time to appreciate it. When a man will train, but will not fight (the most common condition), he needs time and example and informed persuasion from outside. This type (not totally dedicated, because not fully comprehending) sometimes succeeds. Given time, he will learn how to withstand discomfort and become more able to do so. Given example and articulate persuasion, he will see what is possible and often want to emulate. He may even do it with, and because of, the backing of another person, and this person would be a coach even though, perhaps because, he knew no physiology or mechanics but plenty of fact leading to theory. But when a man will not train, there is little chance of his being lastingly persuaded to, unless he is caught early - again, either directly, by some definite compulsion which arises in him, or indirectly, by somebody else's influence. If he is even slight mature in years, and has not matured in character or depth, then he is probably going to make nothing of the sport. I am not here considering that notable, and welcome, type who can race hard, but has other pursuits

The Importance of the Lead Leg in Hurdling

by Les. Mitchell, British AAA Honorary Senior Coach

Ninety percent of good hurdling style - that is, effective clearance of the obstacle - is determined at take-off. The hurdler must leave the ground with sufficient forward lean or 'dip' and be moving at fast speed. And the determining factor at take-off is the use of the lead leg.

Consider: what is the first thing we coaches say to the tyro when he commences hurdling? We say, "Hurdling is sprinting over obstacles." This dictum may be somewhat hackneyed but it is, nevertheless, true and tremendously important. It is essential to maintain a sprinting action, sofar as the 3'6", 3', or 2'6" barriers will allow. In this connection, it is worthwhile noting that the emphasis should be on the legs rather than on the action of the arms. I find it quite adequate merely to say to my hurdlers, "Try to use the arms as you do when sprinting over the flat." Any departure from a backward and forward action of the arms should be limited to the requirement of maintaining balance in the clearance. The lead arm will generally tend to go forward with the trunk to balance the lead leg, but this need not be deliberately coached. It will also have to be recovered well to the side of the body in order to allow for the passage of the trail leg as it comes through. The trail arm should, ideally, move as in normal running, and it is my firm conviction that this will occur if the action of the legs is correct - and, in particular, the action of the lead leg.

The boys whom I coach are used to my constant cry of "speed up the lead leg!" This has to be stressed perpetually. It is a drill for even the best performers to spend much time upon. And for the beginner it is the prime essential in the progress towards a good hurdles clearance, for a slow lead leg will have the following ill effects:

(a) The trail leg will tend to catch up, producing the all too familiar jumping effect, and the trunk will twist to meet it in reaction. Or,

(b) to avoid this, the trail leg will have to be artificially delayed and the arm action halted, thus producing a 'float' over the hurdle.

(c) And, in both cases, there will be a loss of forward momentum upon landing, and the sprinting action will have to be started all over again.

Therefore, we need a fast lead leg, and to achieve this we must bring it through flexed at the knee. This is because a short lever will move much more quickly than a long one. And because of the height of the hurdle, the knee must be picked up higher than in normal flat sprinting. The helpful factors resulting from a fast, high pick-up of the knee are these:

(a) Firstly, it enables the general sprinting action to be maintained.

(b) Secondly, the drive off the ground by the other leg is increased in reaction to the in-

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which will satisfy that potentiality and does not, therefore, wish to give time to training. I am thinking of the man who, when actually in a race as a result of some temporary persuasion, will go hard, yet is too pampered, too skin-deep civilized, too lacking in intellectual or spiritual fertility, to be able to strive persistently through a period of time. He is not so very rare a type. He does not understand striving, because other influences (from society, his pocket, his acquired personal comfort, the generally feeble effort with which he moves) have taken it from him. He is casual, for the wrong reasons.

There is, too, the apprently casual man, who really strives hard, but whose surface casualness defends him against the knowledge of some physical lack. This is a very useful and impressive type, who may not, in practical terms, get very far, yet who is, in a prime sense, a winner.

As the saying goes, therefore, "there are two types of person, the genuine and the humbug"; and, in athletics, the genuine strives to get something out of himself, therby putting something in. Finally, the clubs and coaches, and possibly the athlete himself, will have room only for the man who "will strive with things impossible." Certainly, this kind of man will be the more interesting person to know, to try to understand, and to be influenced by.

creased force resulting from the fast knee lift.

(c) Thirdly, the trail leg is 'left behind', giving a good splits position over the hurdle rail. There is no need to delay it artifically. Therefore, there is no float.

(d) Fourthly, the faster and higher the knee is picked up the more body dip is obtained at take-off, again in reaction to the fast lift of the knee.

(e) And lastly, because the leg is brought up flexed at the knee, it is possible to get closer to the hurdle than would be possible if the leg were lifted straight. This is particularly important in the low hurdles race where it is not necessary to be far back in order to drive across the hurdle rail.

After take-off, the action of the lead leg has been likened to that of a flail with the lower leg swinging freely forward and presenting the heel is driven across the hurdle with quite a positive forward movement, and not merely allowed to swing freely from the knee. This drive of the heel towards the rail sometimes results in a locking of the knee, and every attempt must be made to avoid this. It is important that the lead leg should be kept relaxed in order to facilitate a ball of foot landing. Should the hurdler come down on his heel, his forward momentum will be checked, and he will probably have a nasty headache after ten such landings.

Many authorities claim that the lead leg is snapped down after the clearance is made. This is not so. It moves down in reaction to the pulling through of the trail leg. The faster this is done, the faster will the lead leg move towards the ground. Any attempt to snap the lead leg down would result in the trunk coming upright, again as a result of reaction. This mechanical principle is well known to the long jumper, who, in order to maintain the upright position of his trunk against the tendency towards forward rotation after take-off, sweeps his legs down and back in the action known as the 'hitch kick'. It should be added that if the lead leg is snapped down and the trunk comes upright, the consequent loss of lean will also affect the position of the trail leg, causing it to drop, with the possible result that the foot will strike the hurdle rail as it is brought through. Therefore, do not coach a snap down of the lead leg. Rather, tell the hurdler to pull the trail leg through and attempt to run away from the hurdle. This will help to maintain the sprinting action and ensure the longest possible first stride off the hurdle compatible with speed of movement.

Finally, there is one more coaching point I wish to make concerning the action of the lead leg. As the trail leg is pulled through, the pelvis is tilted to accommodate it, with the result that the lead leg coming down tends to move inwards across the line of running. This, of course, puts the hurdler off balance for his first stride away from the hurdle. The cure for this fairly common fault is to place the flight of hurdles part way across the white line of the lane so that the athlete can run along, concentrating on keeping his lead foot on the line. The coach will naturally stand in front when watching for this fault and while coaching its correction.

And so, to sum up: The correct use of the lead leg is not the whole of hurdling technique, but it is by far the major part. Therefore, even the expert performer should, in all workouts, pay some attention to its movement. If things go wrong with the clearance or with the running between the hurdles, look first at the lead leg before deciding that the angle of the head is wrong, or that the carriage of the arms is wrong. And for the beginner, the action of the lead leg is the first thing to teach as a specific hurdling skill.

"The reading public, the theatergoing public, the skindiving public, the horseplaying public- all these and others fill substantial roles in U.S. life, but none is so varied, vast and vigilant as the eating public. The Department of Agriculture averaged out U.S. food consumption last year at 1,488 lbs. per person, which, allowing for the 17 million Americans that John Kennedy said go to bed hungry every night, means that certain gluttons on the upper end must somehow down 8 lbs. or more a day. That mother hen of the weight-height tables, the Metropolitan Life Insurance Co., clucks that 48 million Americans are overweight."- TIME, Jan 13, 1961, page 48.

The Transitory Hop Shift Method of Javelin Throwing

by William P. Miller

This study began on the premise that the effectiveness of the Finnish method, to co-ordinate body momentum with body force, had been determined inductively. Since all conclusions reached inductively are only probably true; then it can be assumed that there may be a possibility that it is not true. If it is not true, then it is not the most effective method and further, it must be some other method, either known or unknown.

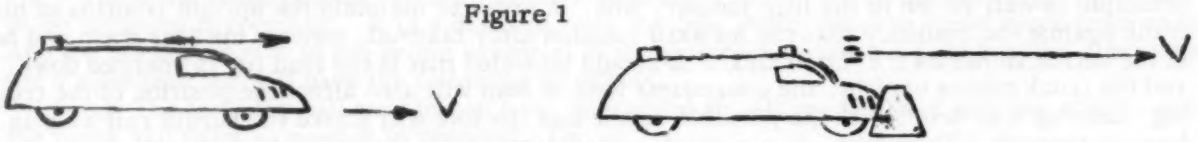
Now, in order to determine which is the best method to co-ordinate body momentum with body force, we must first find what principles or laws of momentum are envolved when the athlete attempts to co-ordinate these forces to the maximum advantage.

Therefore, two laws were found to be specifically involved when a thrower attempts to co-ordinate body momentum with body force. They were: 1. The law of conservation of linear momentum, that is, in impact the sum of the momenta of two impinging bodies remains unchanged.

EXAMPLE:

Look at what happens to a javelin being carried on top of a moving car. (fig. 1) If the car should apply the breaks or run into a solid wall the javelin will continue on with a speed the same as the car, no more, no less.

Figure 1



2. The law of conservation of angular momentum, that is the momenta of a body moving in an angular direction is the product of the moment of inertia of a body about a given axis times the angular velocity about the same axis.

EXAMPLE:

Now compare the previous example with what happens if the javelin is carried on top of a tall massive object and the object strikes a very low wall. (fig. 2)

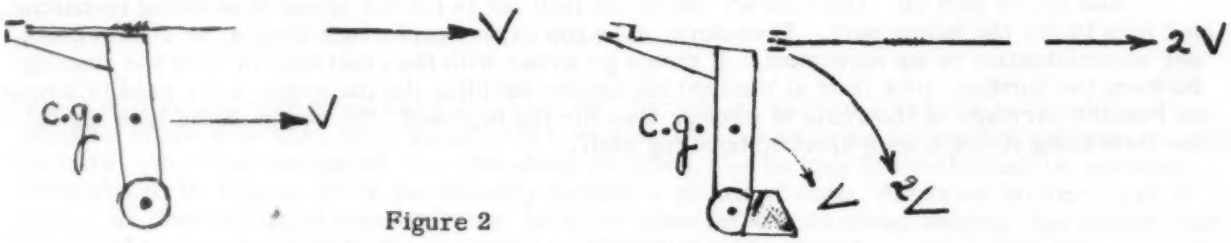


Figure 2

The botton of the carrier is stopped abruptly, but the center of gravity will continue to move on with the same velocity, but in a circle. Now, look at the top. It begins to move with twice the speed of the center of gravity and the javelin could be released with this speed.

Having then established that the law of conservation of linear momentum and the law of conservation of angular momentum could be applied as a general principle to this study and having adduced by the two examples given that they (the examples) were an instance of the general principle; the conclusion was drawn, that if the thrower ran at a given rate of speed and then wanted to apply that momentum to the javelin, then he must do so by making an abrupt stop.

However, in order to fully utilize this phenomenon, the body must be completely rigid.

This is almost an impossibility when you apply these principles to the human body. Nevertheless, it can be approached and the method will be discussed later.

In brief, a general principle was established and was applied to a special case, adduced as an instance of the principle, and from that a conclusion was produced. Assuming that the principle is true, and that the instance cited actually does fall under the principle, then the conclusion arrived at is also true.

The next step was to determine in what manner of action could the thrower perform in order to suddenly stop abruptly and still be in a position and state to apply body force, simultaneously, at the moment he stopped. This was not difficult to deduce. It follows that if he landed one foot at a time this would slow him down only gradually. The full stop would not occur until the front foot struck the ground. Further, if his center of gravity falls behind his foot (as occurs in the Finnish style on the cross-over step and which is taught as a part of the technique), then momentum would be less by virtue of the forces acting on the body, during the time used in bringing that leg foreward into the plant position. Then, if momentum is lost by using this method there would only be one alternative left, and that would be to make such movements necessary in order to land on both feet simultaneously.

In conclusion, then in order to more economically, efficiently and effectively co-ordinate body momentum with body force, the thrower must change from the running state to the throwing state in one quick movement and without any reduction of body momentum.

The logical way to do this is to take off on one leg, make a low glide, assume the desired throwing position while in the air, land in that position and immediately explode into action with all available body force.

DESCRIPTION AND EXPLANATION OF THE "TRANSITORY HOP SHIFT METHOD" OF THROWING THE JAVELIN

The theory of javelin throw is not a difficult one to understand. For example, it would be quite possible to calculate mathematically how far a particular thrower would theoritically be able to throw the javelin under certain conditions and with a given implement. That is, it would be easy, provided that we had specially designed apparatus to measure all the forces and intensity of those forces of a given athlete, and that we knew the flight attitude of a given javelin and had measured and taking into account aerodynamic influences.

The most difficult problem, however concerns the thrower. It regard the ability or inability for him to conform to certain mechanized movements in order to comply with certain laws of physics. In essence, he must do this if he expects to make full use of his latent powers.

Therefore, the solution to a method of throwing the javelin in the most effective way must have its basis in simplicity. If any movement made by the thrower does not influence in a positive way the initial velocity of the javelin, and along the line of intended flight, then it can be said that it is a non-essential one and therefore must be eliminated. The most important factor which contribute to good distance, is the complete control of the mechanized movements envolved in giving the javelin its maximum initial velocity but relative to the physiological capacity and emotional attitude of the thrower.

The employment of the "transitory hop shift method" of throwing the javelin is just one solution to the problem of creating a physiological device which may with more facility control the forces which when proportionally aligned in their ideal form will produce maximum distances. Let it be said that the study of this method is far from complete . It may not be the best method for every thrower either, but at least it is an effort to that ultimate end in finding one which is.

In describing and explaining the "transitory hop shift method" of throwing the javelin, the technique of the hop will be emphasized. All else will be briefly stated.

THE METHOD OF CLASPING THE JAVELIN. The cord grip rests diagonally across the palm and in the hollow betweeen the heel of the thumb and the outer border of the hand. The second finger, the longest and strongest, which also stems from the strongest portion of the hand, is hooked around the back end of the cord and directly over the hump made by the crossing of the cord binder. The thumb aids in securing a firm but relaxed clasp by resting over the back end of the cord and pressing lightly against the second finger. Pull is exerted primarily on the second finger and thumb. The third finger lies on the cord approximately a finger

width apart from the second finger. The forth finger is folded under the shaft with the nail lightly pressing against the palm of the hand and the outside of the first joint against the cord grip. This position helps to guide and control the javelin. The first finger is curled around the shaft behind the cord and is always in a relaxed state. Its function, also, is to guide and control the javelin. It is vitally important to hold the javelin loosely in the hand. No tension should be experienced when holding and running with the javelin.

METHOD OF CARRY. The javelin is carried over the shoulder and parallel to the ground. The javelin moves only in rhythm with the tempo of the run and is not moved back and forth in an intentional manner. When the thrower arrives at his last check mark he begins to smoothly and slowly bring the javelin straight back over the most economical route to a position which will be aligned to the direction of intended throw. (That angle of inclination will always be a constant 45 degree when the wind is not an influencing factor.) This position is reached just as the thrower begins his hop into position.

APPROACH RUN SPEED. The run should start at the distance it takes for the thrower to obtain maximum controllable speed, at the time he reaches his last check mark. Only two marks are necessary. One where the thrower begins his acceleration and another placed at the distance in which he has determined as the point in reaching maximum controllable speed. In short, it is an accelerated run to the point of the last check mark and afterward he maintains momentum by continuing to push hard against the ground, but in a relaxed manner. In effect, he coasts somewhat like a long jumper should do when he makes his gather three or four strides from the takeoff board. Complete looseness and relaxation are essential at this point. The thrower, also at this time mentally prepares himself for the landing and the violent sudden explosive action in heaving all of his available power into the shaft.

THE TRANSITORY HOP SHIFT. In order to make the precise movements necessary for the hop and the subsequent execution of the throwing position, while off the ground, it is essential to plan and measure every action that comes before.

It is recommended, that in the beginning, while off the ground, it is essential to plan and measure every action that comes before.

It is recommended, that in the beginning, the thrower should use a five (5), two (2), hop, shift, land and throw procedure.

The writer used this stride plan in learning to make a proper "hop" and it proved worthy enough to make mention of it her. (fig.3)

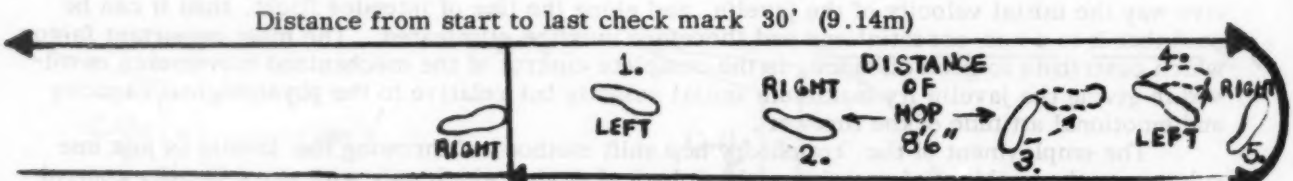


Figure 3

NOTE:

1. Five strides are taken from the starting mark to the last check mark. To learn the hop satisfactorily, it is recommended that only two strides be taken prior to the hop. (The distances marked in the diagram are the writers).

2. The intense force created by the rear leg lift and extension; coupled with the hip wrench will cause the feet to turn and point straight ahead at the time of delivery. This is indicated in the diagram by the dotted lines in foot positions 3 and 4.

After the thrower learns to control more speed he should increase his approach run two strides at a time. For example: a seven (7) stride plan would be about 45' for the seven strides and about 34' for the two preliminary strides the hop and reverse. Following the same procedure: for a nine(9) stride plan it would be about 60' and 36' and for an eleven (11) stride plan about 75' and 38'.

As mentioned before, the thrower draws the javelin slowly and smoothly back when he reaches the last check mark. The movement of drawing the javelin back will have a tendency to cause the toes of the feet on each subsequent stride to turn a little to the right; but this should not hinder forward momentum or cause tension.

Strides one (1) and two (2) are taken naturally and in normal sprinting fashion. The body is always inclined a little forward so as to not allow the center of gravity of the body to fall behind the landing leg. This principle is adhered to throughout the run. At the completion of strides one (1) and two (2) the javelin is all the way back and runs directly along the line of the throwing arm.

At this point the thrower executes the "hop" by making a deliberate drive forward and not up. The thrower will achieve a hop somewhere around 8' to 11' and really depends upon his velocity and leg spring. While in the air he makes a slight turn to the right so that his shoulders, arms and hip are parallel to the directional line of thow. His c. of g. is only slightly back at this point, but his rear leg begins to move up and under his body and with the toe turning to a position so that when he lands it will be facing 120 degrees from the directional line of throw. As he comes down for the landing, the body continues to lean back and his front leg is already far out in front of the rear. Upon landing, the rear foot will only touch the ground a mere fraction of a moment before the front foot. The body angle, at this moment, is about 35 degrees to 45 degrees from the vertical. His front leg is straight but not locked, and the toe turns 45 degrees to the right. The bend in the rear leg should be about 102 degrees. This position is almost identical to the one that Bud Held has utilized so effectively.

The arm is straight back and remains straight as possible throughout the throw. If he allows his elbow to bend a little it decreases the distance in which he can apply force. Also, if the arm is not straight, when the pull is applied by the shoulder, the elbow gives and absorbs the force of the pull rather than transmitting it directly to the javelin. The angle of inclination, of the javelin, is 45 degrees.

The sequence of movements take place in the following manner: The braced forward leg functions as a fulcrum to stop forward body velocity and allows the impact momentum transference to co-ordinate with the body force. This front leg is out in front of the rear leg about 5' to 6'. Actually, the whole left side of the body should straighten. This straightening or resisting is of the greatest importance, for it is around this fulcrum of a firm left side that the rest of the movements can take place properly. Therefore, there must be no give or weakening of this resistance by bending, leaning or falling away to the side. The rear leg aids in lifting the body up and over the front leg and aids body momentum in doing so. The right knee snaps straight, and forces a violent hip wrench which causes an acceleration of the primary throwing muscles of the abdomen and back which pull the chest and shoulder muscles which in turn whips the throwing arm forward at a tremendous speed impelling the javelin forward and up.

When these movements are done effectively, little momentum will be left and it will be easy for the thrower to effect a quick reverse and to stop in four (4) or five (5) feet.

In summary, then, the thrower must align all forces and apply them directly in one line about 10 degrees above the intended flight of the javelin. He runs at just the speed that he can control, takes off on a long low driving "hop" foreward, and lands with both feet almost hitting the ground simultaneously. When this occurs it causes a sudden and abrupt stoppage of body momentum. It is at this time that he applies body force and co-ordinates it directly with body momentum.

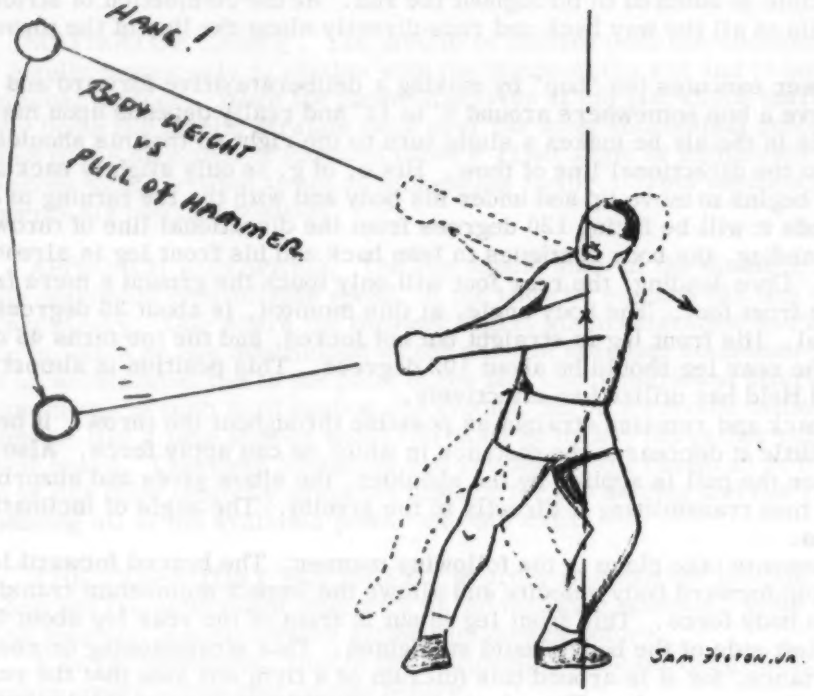
IDEALIZED TRAJECTORY: "Distance of the throw depends only on the launching angle and the square of the launching velocity. Calculated mathematically, the launching must be exactly at 45 degrees. The launching angle is vitally important, for example in an 80 meter throw, an error of three (3) degrees will cause the loss of about 1 meter. (See table 1.) The nose attitude, i.e., the angle of the javelin with respect to the air which moves by it as the result of the forward movement, should be about 10 degrees above the launching angle".

Table 1: Loss of distance because of errors in the launching angle.

ANGLE ERRORS	PERCENT LOSS OF DISTANCE
1.4	0.25 %
2.9	1.10 %
5.8	4.0 %
11.6	14 %

Hammer Notes

(Second in a series by Sam Felton, Jr., fourth placer in the 1948 Olympics.)



COMPLETION OF EACH TURN

1. Entire body has swung way around left side and entire body weight hangs against hammer as it descends - weight remains over left foot all throughout this last half of the turn.

2. Right foot lands (or, actually, slides in) before hammer reaches its low point - and its low point must be as far to your right as possible.

3. Your weight must remain on your left foot as your right foot lands - don't give in to the pull of the hammer (don't let your weight shift to your right foot). Note the center of gravity line which passes through your left foot.

4. Upper body is facing to right, in direction of the hammer - head should usually face to right too (if head turns to left, upper body will too, and hammer will get ahead of you).

5. Arms by and large remain in same position relative to upper body all throughout each turn - and left arm should remain across your chest (with right arm bent a little).

6. Keep tight hammer wire all throughout turns - never let it go slack.

7. During back half of turn, throw entire body weight against pull of hammer - and throw it hard - exert as much pull against hammer (through entire body weight, not arms) as possible without being pulled on your right foot.

THE MAN WHO WINS

The man who wins is an average man,
Not built on any peculiar plan,
Not blessed with any peculiar luck,
Just steady and earnest and full of pluck.

The man who wins is the man who works,
Who neither labor nor trouble shirks,
Who uses his hands, his head and his eyes,
The man who wins is the man who tries.

Anonymous.

(Reprinted from "Vigor" magazine, Vol. X, No. 2, March, 1957, page 10.)

Relay Questions and Answers

We are indebted to English Chief National Coach Geoffrey Dyson for the AAA Honorary Senior Coaching Award questions for 1960. These are answered by David J. Fruin, AAA Honorary Senior Coach and leading English relay racing authority, at the specific request of TRACK TECHNIQUE.

Question 1.

"Given the time to amass the necessary data, a coach should know more about the individual runners of a 400m Relay team than their 100m and 200m times in competition; for these details are not a sufficient guide to speed-distribution over the four 'legs'." Discuss this statement.

I cannot imagine a coach disagreeing with this statement. The basic problem of this event is primarily one of baton speed with the three critical points, the changeovers. The incoming runner is normally sprinting at a satisfactory speed but the outgoing runner has only approximately 18 meters in which to accelerate from stop to the point of receiving the baton. A sprinter needs more than 50 metres to attain maximum speed therefore everything must be done to maximize the outgoing runner's momentum at the point of changeover. The obvious rules are that he must commence sprinting with maximum acceleration at precisely the correct instant, driving with both arms, with the changeover as late as practical in the pass zone.

Now to revert to the question which concerns the order of running the four sprinters. The four stages of the race can be tabulated as follows:

	Distance, in meters, to be covered by each sprinter.	
Stage	With baton.	Without baton.
1.	108	108
2.	100	118
3.	100	118
4.	92	110
Total	400	454**

**54 meters or 3x 18 meters duplicated.

This table indicates that time trials should be run over:

1. 108 meters from a normal crouch start to assist in deciding the first stage runner.
2. 18 meters from a relay crouch start (i. e. one armed crouch) to assist in deciding the other stage runners.
3. 118 meters from a relay crouch start to serve as a check for 2 and to ensure that there will be no risk of "fade out" by the incoming runner at the end of the second and third stages. This is rarely encountered with adult, male athletes of reasonable class.

The starting ability of your first runner is not of prime importance. The main factor in deciding the first runner is his time over 108 meters. Any fast starters are needed on the other stages where their superior acceleration can minimize the loss of baton speed implied in my opening paragraph. Often at this stage, coaches are faced with conflicting factors, e.g., the fastest man over 108 meters is also the fastest starter. Thus the best three must be juggled with over the first three stages and only experimentation and further time trials can decide in some cases. However this experimentation must be finalized as quickly as possible, for relay training sessions with settled teams are always in short supply. The last stage is often the easiest to settle. The slowest man should be used here provided that he is a reliable, relaxed finisher, i.e., does not yield to the temptation to fight and 'tie up'.

Other factors that the coach should note from observation and, in some cases, further time trials are:

1. Bend(turn) versus straight sprinting ability of the members of his team, bearing in mind that smaller and more compact sprinters perform better on a bend and taller sprinters can be used to better effect on stages starting at the end of a bend.
2. Avoid if possible running the tallest and shortest on consecutive stages.

If time indeed does allow time trials to cover the effects of these latter points then they can be as follows:

1. Time the team members over the relevant stretches of bends included in the different stages.

2. A useful check of efficiency and measure of progress is to time the interval from the crossing of the first line of a pass zone by the incoming runner until the crossing of the last line of that zone by the outgoing runner.

Finally, do not crush without due consideration, discussion and possibly time trials any instinctive or traditional preferences of the members of your team.

Question No. 2. Describe the training you have given a 4 x 440 yards relay team, including all information relevant to a description of your coaching methods?

In view of the variable pace of the approaching runners, visual takeovers (sight passes) are used. A well drilled sight pass is dependant on the outstanding judgement of the outgoing runner. It is his responsibility to take the baton from the tiring incoming runner at the correct point in the pass zone, developing at the same time the maximum possible momentum himself. The faster that the incoming man is approaching, the later in the zone can the takeover occur; but in view of the particular importance of speed into the first bend of each stage, it is usually wiser for the pass to occur early in the zone. Thus it seems that with athletes of reasonable intelligence who fully understand the above factors and realise that the odd yard can be gained at each changeover, practice and experience with teammates are more valuable than the repeated coaching of technical detail. Nevertheless the coach is important in his advisory capacity as this relay produces particular mental stress, e.g., a novice can be faced with a lap alone with a champion in a dual meeting. In a bigger meeting, conditions for the last three stages are nearer to an 880 race than a normal 440 race in lanes. It is indeed fortunate if any of your men have had 880 experience.

Whenever possible the order of running should become an established factor so that the runners become used to each other. If the first three can run with confidence in the anchor man, then they will perform better. On the other hand it is usually advantageous to be in a forward position in the race after the first stage, therefore your two best athletes normally cover the first and last stages between them with the slowest man on the second stage. Occasionally, when you are fairly sure of victory or you are fairly sure of victory or you have outstanding confidence in the anchor man, the team can run slowest, second slowest, second fastest, fastest which normally leaves each runner with someone in front of them to beat. Rarely successful is the policy of establishing a lead during the first two or three stages and running the slowest man last.

Always study opponents and whenever possible their order of running. This can influence your own order of running as with intelligent coaching and discussion you can prepare your team to defeat man for man a team of tough or tougher opponents.

Now a few words on baton handling. Baton pointed forward and slightly downward by the incomer promotes a smoother exchange than with the baton pointing upwards. Whether it is preferable for the outgoer to take with the palm up or down is debatable and can be left to be settled in discussion by the team. I consider however that the palm upwards position can be safer.

Regarding training, the team should be encouraged to carry out their normal track training together whenever possible. Additional exercises designed specifically for the relay should be blended in with their normal work, e.g. continuous lapping by the team, each member sprinting or striding 110 yeards at varying speeds, passing the baton and jogging back 110 yards to meet the baton again. This is of fair value in providing experience for the outgoing runners but just as important, it develops team spirit. A more valuable exercise is to split the four into two pairs, add one athlete to each pair and have the trios running 220's against each other for up to 10 minutes after the fashion of a dreilauf. Vary the teams in subsequent sessions to ensure all three changeovers of the actual relay team are rehearsed. Other benefits can be obtained by running your 220/440 men in non-scoring extra teams in 440 yard (4x110) relays and by running all four together in 880 yard (4x220) relays.

Question No. 3. List 6 principal faults in 440 yards relay racing, and describe how you have attempted to correct them.

I. Outgoing runner starting too early or too late. Team members must be made to realize that they must watch with absolute maximum concentration for the instant when the incomer's foot hits the prescribed mark and then immediately commence sprinting "all out". There must be no inconsistency. The coach should check that the mark can be clearly seen from the outgoing runner's position by using flat headed colored pegs or colored chalk etc. He must also check that the approaching athlete's velocity is uniform. Adjustments of course will be made for consistent, improved acceleration resulting from practice but if after repeated and intense practice an athlete is still erratic, consideration will have to be given for his replacement by a more reliable athlete even if the latter is less speedy.

II. Outgoing runner not starting with maximum acceleration. This usually denotes lack of confidence by the runner in his approaching colleague and can normally be eradicated with practice. The outgoing runner must realize that provided he starts sprinting all out at the correct instant then it is up to the incomer to catch him at the change-over point.

III. Outgoing runner trailing receiving arm over whole of pass zone and not holding receiving arm steady. Intensive coaching and repeated practice normally corrects this. The outgoing runners should be encouraged to count their strides and for the first five or six strides drive with both arms, gradually raising the upper body as in a normal crouch start. Then, on or about the seventh stride flick the receiving arm deliberately into the receiving position and hold it steady. He should not feel for the baton but almost be disinterested in the whereabouts of the baton and continue complete concentration on acceleration. It is up to the incomer to place the baton in his palm. By the ninth stride he should have received the baton and be resuming normal sprint action.

IV. Allowing transfer of baton from right to lefthand (or vice versa) to interupt concentration, flow and momentum of sprint action. This does not arise where alternate hand changeovers are used. It occurs only when teams use left to right hand-overs at all three points. Then the second and third stage runners have to switch the baton from one hand to the other while covering their stage. The interuption caused in concentration and sprint action can be minimized by training the athlete to carry out the following drill; immediately on receiving the baton in the right hand, the right arm drives forward and the right hand meets the left hand in front of the chest, the switch is effected, the left arm continues driving backwards and the right forward. This drill soon becomes automatic and slick.

V. First stage runners unable to hold a satisfactory starting position with fingers while holding the baton. This is an extention of a general problem for sprinters on how to hold an efficient crouch start position with shoulders at maximum height which partly depends on a satisfactory bridge position of the fingers. The cure is usually effected by strengthening exercises, e.g. fingertip, press-ups, pull-ups, screwing up newspaper sheets with one hand etc. The fingers should point nearly vertically downwards from the hand but nevertheless be splayed out as much as possible from each other. I prefer the baton to be held by one finger only - the finger next to the smallest finger.

VI. Incoming runners obstructing other teams after the changeover has taken place. This is a contravention of the rules as well as a fault and therfore can cause the disqualification of the whole team. Individual runners must bear this in mind and in spite of the excitement of the occasion, remain in their lanes until all of the teams are well on their way on the subsequent stage.

Question No. 4. Compare the baton-passing techniques used by Great Britain, the U,S.S.R., and the U.S.A. in the Olympic 400m Relay at the 1956 Olympic Games. State your prefernce, giving reasons.

From the normal habits of these three national teams, it seems the main point for discussion is a comparison of the 'free-distance' techniques normally used by G. B. and the U.S.S.R. with the safety first techniques used by the U.S.A.

To enlarge on these terms, 'free-distance' refers to the distance (usually about two feet

per changeover) gained by the outgoing athlete reaching back for the baton whereas in safety first techniques the receiving hand is held close to the waist or hips with either the fingers (basket pass) or the thumb pressed against and steadied by the waist or hips.

I consider that all three teams have been following the policies best suited to themselves. The U.S.S.R. and G.B. had everything to gain and nothing to lose. More particularly the G.B. team, if they had not stretched every point and taken all risks they wouldn't have reached the final. On the other hand, the U.S.A. proved their policy by retaining the title. They had an awful lot to lose if they dropped the baton. However, like many others I should like to see the U.S.A. compete in a meeting, other than the Olympics, gaining the benefit of a free distance' technique. To study these three teams in more detail I have analysed below their performances in the 1956 final.

Team	Position	(A) Time	(B) Total time of four**	Bonus A Difference	Free Distance Gain	Flying Start Gain
U.S.A.	1st	39.5	41.4	1.9	-	1.9
U.S.S.R.	2nd	39.8	42.6	2.8	0.3	2.5
G.B.	3rd	40.6	43.2	2.6	0.3	2.3

** Represents total of normal non-relay 100m times that could be expected from the members of the team.

The right hand column indicates that the U.S.S.R. team's technique was excellent, the G.B. team's technique nearly as good and the U.S.A. team's not so good as a result of their safety first tactics of not gaining free distance and passing the baton four to five meters before the end of the zone. This was only partially compensated by the U.S.A. sprinters' superb acceleration. In the final the U.S.S.R. held the U.S.A. for the first two stages by regaining distance at the first two changeovers. However the U.S.A. reserved Baker and Morrow until last. The former gained a yard lead and Morrow stretched this out to three yards at the tape. Only a team that outclassed the opposition in this way could get away with such "luxurious" tactics and order of running.

Question No. 5. Write shorts notes on: (a) The 'ultimate' in the 400m (men's) relay. (b) Technique in shuttle relays. (c) Baton passing in the 4 x Mile Relay.

(a) The U.S.S.R. differential of 2.8 seconds mentioned in question no. 4 was maintained or even improved upon in the recent Moscow match versus the U.S.A. Furthermore, it exceeded some published estimates of what time could be saved in a relay. Subtracting 0.3 seconds as a generous allowance for free distance, we are left with 2.5 seconds as the saving from the three flying starts. If this is divided by three the resulting 0.83 is approximately what one would expect from a 20 yard flying start by a top grade sprinter. Nevertheless as a 2.8 saving has been attained we can assume that this is not perfection and can confidently hope and work for a 3.0 second saving.

If supplied with four 10 second 100 meter men and if the 3.0 second differential is subtracted from their total of 40 seconds, we are left with relay record of 37.0 seconds."

(b) Shuttle relays are now normally confined to hurdle and/or indoor events. Running order is decided by: 1. Best starter first. 2. Wind direction, some perform better against the wind than others. 3. As there is little time during the race to change the position of starting blocks, endeavour to have men with approximately the same starting positions starting from the same end. 4. Best men first in order to obtain a forward position which entails less distraction for subsequent runners. (I am usually in a minority of this latter point.) Athletes should get on their marks when their team mate is half way through his stage"and get set" as he crosses the last hurdle. Incoming runners should start the outgoer with a light downward tap on the shoulder, as they pass, that will not intefere with the balance of his 'set' position and his imminent upwards and forward drive.

(c) Most of the interest of the 4 x Mile Relay concerns the order of running and the 'front running' ability of individuals. However, the question concerns baton passing. Many of the rules applying to the 1 mile relay (see question no. 2) also apply to the four mile relay e.g. visual changeover (sight pass), main responsibility resting with the outgoing runner to take the

A Natural Way of Shot Putting

by John T. Powell, University of Illinois

Discussing basics of shot putting techniques with Gustaf Laurel on his recent visit from Sweden, it was agreed that a major problem with young people---attempting to use a type of "O' Brien technique"--is the precarious balance position at the start of the put occasioned by their physical immaturity.

Lack of strength in the lateral abdominal muscles, underdevelopment of the thighs, and the absence of an overall power are reflected in the inability of the young athlete to allow the shot (preparatory to the put) to be maintained, as it must be, at the neck, and yet at the same time outside the rim of the circle, while still being capable of exerting maximum drive across the circle.

Therefore, the young athlete must adjust to a compromise position--bringing the shot

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Book Review

FUNCTIONAL HEALTH TEACHING

(Fourth edition) By Howard S. Hoyman. Published by A. J. Nystrom & Co., Chicago 18, Illinois. Pp. 288. $4.50

The fourth edition of this book, published in 1960, is illustrated with 33 Graphic Health Charts. It provides practical, up-to-date information in the area of health and physiology presented in a way which may be easily understood by the reader without special training in science. Readers with a minimum of science background will find this book interesting and informative. Its contents are basic to an understanding of the principles of physiology so important to modern day training and performances. Coaches and athletes with a strong science background will find Functional Health Teaching a pleasant reminder of facts which have been allowed to become dim to the memory through atrophy.

Functional Health Teaching and the Graphic Health Charts are based on modern educational principles designed for school use. The book includes practical teaching suggestions, key health questions, and selected health activities. The 33 Graphic Health Charts in the book are also available in size 32 x 44 inches in color at a price of $58.50 for the entire set, complete with tripod.

Dr. Hans Kraus, Associate Professor of Physical Medicine and Rehabilitation at New York University, found that physically inactive people are more likely to suffer from organic troubles, diabetes and psychiatric illness than physically active people. He came to the conclusion that physically active people suffer less and live longer, and he advises doctors to prescribe physical exercises together with pills to keep their patients healthy. (Reprinted from "Vigor", June, 1955)

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baton at the correct point and the correct point is usually early in the pass zone; particularly in this event where only 5 to 7 yards are needed to attain the average speed of the baton, after which the outgoer can continue accelerating into the first bend in order to open or close gaps between him and other teams. The longer the relay, the less important the baton passing but because of this 2 mile and 4 mile relay teams tend to neglect the changeovers and this creates scope for the teams and coaches who do take trouble over baton passing, to gain much more than they could hope to in the shorter relays.

nearer to a position above the toes of the supporting foot. In consequence, the distance through which the shot travels before release is reduced, and thus is nullified the first premise of the "O'Brien technique".

The stronger young performers, with much practice, adapt to their inadequacies and develop individual styles. But many potential putters cannot adjust easily, are discouraged, and may even give up the event.

The "Natural" Way:

This is a satisfactory method of introducing the put to beginners. It is suprisingly easy and will give immediate results, particularly in class participation. I have tried this method with large groups and it has proved very successful.

The following description is in reference to a right-handed athlete.

Starting Position:

Stand on the left foot, at the rear of the circle, toes touching the inner rim, knee bent, straight left arm extended forward and down until hand is in line with left knee, body bent slightly forward from waist. The right leg is extended backwards with toes touching the ground. The shot is pressed to the neck by three fingers, putting elbow down but not under the sphere. This must be a comfortable position, body being not too low. It is of help to place a marker on the ground about 10 feet away from, and in line with, the toes of the left foot. The putter should direct his gaze at the marker, for as long as possible. This helps to preserve the low trunk position.

Note the relation of the shot to the rim of the circle; as confidence is acquired so the weight can be held even further outside. As has been mentioned, the further outside the shot is held in the usual stance (on right leg), the more difficult it is to drive the body across the cement. By standing in the "natual" position (on the left leg), the shot can be held further back, without loss of balance or weakening the "driving" position, than is possible otherwise.

This "natural" position eradicates any tendency to introduce rotation at the start and, in consequence, the shot is in a far better position to be propelled in a straight line. Start in this position, do not "drop" into it.

The Drives:

The right leg is raised slightly---heel leading, then the body-weight is lowered fractionally, whereupon the left leg drives until it is straight so that the right foot comes quickly to ground at about the circle's centre---initially on the ball of the foot. The left foot is pulled through fast (and close to both right leg and the ground) until it drops close to the stop board. Foot positions must remain parallel throughout, to avoid rotation.

During this phase the body-weight is kept low until the left foot is almost grounded. Meanwhile the right leg has begun its drive, and the thigh is vigorously lifting the trunk laterally, the the left arm has been pulled close to the left side, the shot is still close to the neck, and the gaze is still on the marker.

From now on the usual putting technique obtains.

For a detailed description of the principles of putting which I advocate refer to my article "Mechanics of the Shot Put" in the December 1960 issue (No. 2) of "Track Technique".

To summarize, the following advantages result from the "natural" position:

1) Better balance is preserved and a greater measure of control is ensured.
2) No rotational element is introduced at the start of the put, as this tendency is primarily the result of forcing the body up, from a weak position.
3) The "dead-pause" (which is so noticeable in young performers when landing from the usual glide) is eliminated, because of the smoother transition.
4) Continuity is preserved throughout the whole action.
5) "Cocking" (at the end of the glide) of the putting arm which takes the shot away from its line of direction, is also eliminated.
6) It is easy to preserve the shot over its imaginary line of application of force.
7) Progressions, in power-application and speed, are easily introduced as these do not now depend upon a relatively weak starting position.

There is very much more to the technique than has been expressed here; however, it is hoped that enough has been propounded to interest coaches and their young athletes sufficiently to encourage them to try this "natural" way to putting.

The Athlete and Adaptation to Stress

(Second in a series of three articles.)

by Forbes Carlile, Australia

APPLICATIONS OF THE STRESS CONCEPT TO TRAINING

The particular aim of training is to stimulate specific adaptation of the body by continuously repeating physical exercise of a specialized nature. Harmful effects of exercise stress becomes a more likely condition nowadays that rewards for sporting success are many, and high training mileage has become almost an obsession with many athletes and coaches.

Selye's concept that the body has a finite quantity of Adaptation energy and that stresses should be summated when considering their effects on the organism, he has started to be his most important ideal gained from his many observations on stress research.

It was stated in Part I (Track Technique No. 5) that an important result of chronic exposure of the organism to a particular stress is to increase the resistance to that stress but to reduce the non-specific resistance to other stresses. The athlete may withstand a relatively great load of a particular exercise forwhich he has been trained, but more easily succumbs to other stressing agents such as chills and bacterial infection than the normal healthy person. This is not an uncommon observation.

Any stress, muscular exercise or otherwise, whether major or minor, according to Selye draws on the bank of adaptation energy, but the stresses for which the individual is less well adapted will draw the greatest debit and be most likely to hasten exhaustion reactions.

STRESSES ON THE ATHLETE

There are two important practical questions, firstly, what are the main stresses which may make a demand on an athlete's adaptation and, secondly, what signs and symptoms are indicative of a failing store of adaptation common to many athletes:

Muscular exercise; dietary inadequacy; climatic conditions, heat and cold; bacterial infections and disease; emotional conflict and unrest; insufficient rest and sleep; and miscellaneous stress--everyday wear and tear of living.

There is space only to comment briefly on this list and to mention some implications.

Even when everything seems ideal for an athlete's training it is fairly common knowledge that it is possible to overload the athlete with too much or too intense training. It is not proposed to go into training schedules here, but the general practice should always be to increase gradually the training load, giving the body time to make its changes of adaptation. Starting into a too severe training program with more enthusiasm than wisdom is a common cause of failure. Training should be increased gradually, not only in the one season but year by year.

Here is a very important lesson of the G.A.S. (the General Adaptation Syndrome). Exercise causes an Alarm Reaction with an emphasis on the countershock stage, and during this stage the individual may be mislead by his feelings of well-being even though his general powers of adaptation will be low and he may be fast traveling on the road to the Exhaustion Stage. An

In order to have developed a high specific adaption for exercise it may be presumed a normal occurrence for the athlete to be at least in the early stage of resistance. Should he have passed too far into this stage, specific and general adaptation will be nearing their limits. A not particularly severe stress such as a race or time trial may then represent the last straw to his load.

The diet which may be completely satisfactory for the normal relatively inactive person may not contain the necessary quantity of nutrients, particularly vitamins for very strenuous training. There seems fairly good evidence (1 and 2) that Vitamin C and some of the Vitamin B Complex series fall in this group. Moreover, it is conceivable that there exist personal idiosyncrasies, some individuals needing considerably more of some chemicals than other for optimum function of their living processes.

It is interesting that Selye's rats made greater adaptation when on a high protein diet. Another point which may be overlooked by athletes is that food which may be easily handled by the digestive system of the normal person may constitute a stress to the athlete. A fat-rich or

too bulky diet may be considered as falling into this category.

High temperature and high humidity often represent important stresses for nearly all athletes except the swimmer. When the body is generating heat at a high rate during exercise, to lose heat becomes a problem, and increased body temperature can become a severe stress. To the long distance runner or rower who must train on cold nights and also the swimmer practicing in outdoor pools, cold can take a severe toll on the athlete.

Bacterial infection and disease may be thought of as calling on a great deal of adaptation energy precipitating the G.A.S. Added to the physical exertion of training, disease might well be expected to precipitate early exhaustion. Such is found to be the case in practice. It is an ill-advised athlete who trains or races when ill.

Of interest is Selye's most controversial theory of the diseases of adaptation. Many diseases, he says, those which are not caused by any known pathogen, are caused more or less directly by stress. Such diseases as rheumatoid conditions, chronic high blood pressure and gastric ulcers he calls the stress diseases. It is certainly a well established fact that many conditions including psychotic and neurotic mental states, in fact most illnesses, may be precipitated by stressful conditions. Selye believes that the mechanism involved in his so-called Diseases of Adaptation is mainly a "derailment" of the body's hormone responses. Most psychosomatic research workers consider that this may, at most, be only one of a number of biological mechanism involved.

There is, however, nearly complete agreement that the sick person must have as many bodily stresses as possible reduced to a minimum for his speediest recovery. The athlete in orde to produce his top performance similarly is found to require much rest and should keep warm and eat mainly easy-to-digest foods. Paradoxically, the athlete and the sick person require much the same type of treatment. Both require to save their adaptation energy.

Only a psychologically well adjusted and happy person will have a minimum of psychic unrest. Mental stress probably causes some body effects which acting through the nerve centers of the hypothalamus in some way (as yet uncertain) influence the anterior pituitary gland. The anterior pituitary in turn secretes the hormone A.C.T.H. which transported through the blood stream stimulates glandular activity in the adrenal cortex. The fact that emotional upset can affect the body and is associated with many types of physiological malfunction and disease certainly suggests strongly that the emotionally well balanced athlete with a good temperament and who has the personality factors generally associated with a "good sport" has an important advantage over the unhappy, restless individual who is kept busy dealing with battles not only in his competition but within himself.

Insufficient rest and sleep may be another stress decreasing adaptation energy and hindering maximum specific adaptation for muscular exercise. An athlete may be habitually getting insufficient rest and blame poor performance on everything except this fundamental restorative need. The athlete requires more rest than the non-athlete, but as far as the author is aware scientific information concerning the optimum sleep requirement during strenuous training does not exist.

Under the heading of miscellaneous stress, many and various factors could be discussed. For instance, smoking and drinking to excess may be stresses fairly well carried by the otherwise relatively non-stressed person, but to the athlete such indulgences will probably be at an adaptation cost he cannot afford. The everyday wear and tear of living involving the athlete's occupation, his traveling to work his hobbies, studies, and not least his social obligations, are all performed at the cost of some energy of adaptation. Serious consideration of these activities must be given by all concerned in preparing an athlete. These everyday stresses, outside of training itself are of utmost importance and should be first considered when planning a schedule and observing reactions to training.

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How They Train

by Ted Corbitt

SERGEI K. POPOV, "Locomotive" Sporting Club, Russia. Age 31. Works as an electro-mechanic for the Trans-Siberian Railway.

BEST MARKS: 100m, 12.7; 400m, 56.0; 1500m, 3:52.2; 3000m, 8:30.0; 5000m, 14:18.0; 10,000m, 29:52.0; 15 km, 45:07; 20 km, 1:01:30.0; 30 km, 1:32:58.8; and marathon 2:15:17.

BORN: September 21, 1930 at Kjachta, Siberia (Burjat-Mongol ASSR); 5'3" (1.6m) tall, 119 pounds; (54 kg.) started racing in 1953 at age 22 while in the Army.

PRE-RACE WARMUP: 15 minutes of running, with an acceleration sprint at the end. General exercises 5 minutes. Rest about 30 minutes.

PRE-TRAINING WARMUP: 20 minutes: 15 minutes easy running and 5 minutes of general exercises.

PRE-COMPETITIVE (WINTER) SEASON TRAINING: Monday: 30-35 x 400m in 68-70 seconds, and 10-15 x 200m with rests of 80-100m jogging after each. Tuesday: Cross-country at an even speed for 1-1½ hours. Wednesday: Cross-country at alternating speeds for 1¼-1½ hours. Thursday: Steady or constant speed-running for about 1 hour. Friday: 15-20 x 1 kilometer in 2:55-3:00 with rests of 300m jogging. Saturday: Cross-country for 1-1½ hours with accelerations en route after each. Sunday: Morning, ½-1 hour easy running.

The training runs are usually done in pine forest woods on soft ground or occasionally on park roads. General conditioning exercises are an important part of Popov's pre-competitive training.

COMPETITIVE SEASON (SUMMER) TRAINING: Summer training is about the same as in winter but the running speed is somewhat more intense in summer. For instance, 30-35 x 400m in 65-67 seconds with rest intervals of 40-50m jogging after each. After a 40 minute morning run, Popov does general conditioning exercises. The competitive season ends in October. Off season lasts 1-1½ months, and it is featured by rest with some easy cross-country or basketball.

Popov usually trains twice a day; Mornings, 30-40 minutes of easy running, between 7-8 A.M., and again either 12-1:30, or at 5 P.M. He does not worry about the weather, having trained in 40 degrees below zero (F) temperatures. Some of his summer training is deliberately done in hot sunny weather to prepare for races in such conditions. In heavy training, he runs up to about 500 miles in a month, but he never does more than 31 miles in a single day.

Training goals are: the building of general endurance--by runs at 14-17 km or more per hour for 2-2½ hours in the woods with variable speeds, including accelerations of up to 1000m; and special endurance--by either runs of up to 1½ hours with variable speeds, or running on the road, e.g., 15 km in 47:07-48:30; or 20 km 1:04:20-1:06:00; and speed-- 100m-3000m runs, but mostly 400m bursts, made progressive by increasing the speed of the repetitions and by shortening the recovery runs. The rest intervals are shortened to 60-80m while running 400m in 65-67 seconds. Some of this speed work is done with spikes on and is timed with a stopwatch. He recovers quickly following the workouts. His objective is to prepare to average about 16:30 for each 5 km in the marathon. His light, fast, economical gait, is accompanied by a stride rate of 192-196 per minute, and a stride length of approximately 5'3½".

In addition to special running exercises and general conditioning exercises, Popov does weight training. During the winter he trains with barbells. In summer he lifts stones. He is able to lift more than his body-weight overhead.

Popov's last pre-race meal is eaten 5 hours before the race. He has no fads as regards food. In his record run at Stockholm he took 2 glucose tablets at 30 km and hot tea at 35 km. He rests one full day, and then takes a warm-up the day before a race. The 11-13 races he runs per year includes: 1 indoor, 6-7 outdoor, and 4-5 cross country competitions.

Strategy: Popov tries to cover the distance to a pace schedule, inspite of the tactics of his rivals. However, he trains for and employs accelerations of different lengths during the race to soften up his rivals. His first marathon (1956) pace schedule called for even paced running for the first 13 miles and an increased pace over the last half of the race. He ran 2:24:34.8, displaying a strong finish, for 6th place.

Comments: Popov, 5th in the Rome Olympic Marathon in 2:19:18.8, became a marathoner in the ideal way, that is by first running track, cross country, and shorter road races. Only in this way is the man assured of developing his greatest speed. On June 14, 1952, England's Jim

Peters raced the marathon in an (at the time) unbelievable 2:20:42.2. The art of running the marathon changed with that race. Speed has become increasingly important. Today, throughout the world, the marathoner who can average 6 minutes a mile under any and all course and weather conditions will still give a good account of himself. However, the major victories will go to the men who can average 5:20 (plus or minus 10 seconds) per mile.

The marathoner's training is concerned with the conquest of distance and time. Almost all men who train for the marathon acquire enough stamina to cover the distance. Running a fast race is more difficult to achieve. Some marathoners occasionally run about 30 miles in training in an effort to extend their "quitting time"and to build up confidence. Popov uses a combination of the steady fast runs employed by Jim Peters and the fast-slow type of running of Zatopek. However, the Russian has added more variety to these regimens. None of these three marathoners admitted to running over the marathon distance in single training runs. They built speed and stamina at the same time with multiple under distance runs.

Several marathoners now on the scene are probably capable of taking another 5 minutes off of the fastest marathon time. Both Popov and Abebe Bikila (Olympic Record: 2:15:16.2) were relatively fresh after their record runs. Popov stated after his record run that he believed that he could run 2:10. Still on the speculative side, there should be another significant reduction in marathon record times when sub-four minute milers such as Halberg, Elliott, and others give it a serious fling. More (fast) track distance runners should be encouraged to try the marathon before they retire from serious running. Such excursions, in themselves, do not detract from a man's speed. Many have returned to track to produce faster times. Herb Elliott's occasional stamina runs of 29-34 miles is a prominent example. Popov, who was on the verge of quitting running in 1956 because of a chronic stitch, lowered his 1500m time from 4:40 at age 22 to 3:52.2 at age 30. He took 7 seconds off of his 1500m time after his record marathon run. It appears to be important for the marathoner to keep striving for fast track, and sub-marathon road and cross-country times in order to further reduce his marathon time. It is the merging of speed, stamina and determination which gives the champion that extra lift that puts him in front of the pack.

References:

1. INTERNATIONAL ATHLETE, No. 1, November, 1958; No. 3, January, 1959; and No. 8, November, 1959.
2. Shorea, P., "The Training of Marathon Runner S. Popov," LIGHT ATHLETICS MAGAZINE, August, 1958.
3. Fred Wilt's TRAINING AND PERFORMANCE PROFILE QUESTIONNAIRE, April 18, 1960

Book Review

EFFICIENCY OF HUMAN MOVEMENT

By Marion R. Broer. Published by W. B. Saunders Company, West Washington Square, Philadelphia 5, Pa. 1960. pp. 351. $6.00.

Since the human body is made up of weights (mass of body segments), levers (bones), and devices for producing force (muscles and nerves), it responds to the laws of mechanics just as any other system of weights and levers. These principles are the same, regardless of the type of activity. This book is devoted to the understanding and application of mechanical principles which may be applied to human movement in any activity. Basic laws are explained so fully that a background in physics is not necessary to understand the discussion of principles.

Track and field coaches and athletes, who are constantly faced with problems in efficient movement, will find this well-written and superbly illustrated book an invaluable contribution to their chosen sport.

How They Train

by Fred Wilt

WILLIAM DAVID "DAVE" POWER, Western Suburbs Club, Sydney, Australia, age 33.

BEST MARKS: Marathon, 2 hours, 22 minutes, 45 seconds; 10,000m, 28:38.2; 5000m, 13.51.8; 3 miles, 13:24.0; 2 miles, 8:45.0; mile, 4:00.2; 880 yards, 1:54.5; 440 yards, 49.8; 220 yards, 23.0; 100 yards, 10.4 sec.

BORN July 14, 1928, at Maitland, New South Wales, Australia, 5' 8" (173cm.), 140 lbs. (63.6kg.), started racing in 1945 at age 17.

PRE-RACE WARMUP: Jog approximately 3 miles slowly in 30 minutes, with a few short, fast runs enroute during latter part. Rest 10 minutes prior to race.

PRE-TRAINING WARMUP: Jog one mile at a medium pace.

WINTER TRAINING: (May, 1959) Saturday and Sunday: 15 miles of continuous running on the beach, starting with 3 miles jogging on hard sand, then 3 miles running up and down soft sandhills, then 5 miles running on hard sand and sometimes through water, then 4 miles of gradually increased speed, and finally an all out effort over the last mile. Monday, Wednesday, and Friday: 8 miles of continuous running on the beach, starting with 7 miles at 3/4 full effort, and finishing with last mile at full effort. Tuesday and Thursday: 8 miles of continuous running on the beach, starting with 7 miles at 3/4 full speed (3 miles of this over soft sandhills), and finishing will full effort over last mile.

During the lunch hour at noon, Monday through Friday, Power jogs 4 miles on a grass oval, followed by 10x100 yard sprints with 50 yards recovery jogging after each. According to inclination, he "occasionally" jogs 4 miles in the early morning during this period. All beach running is done barefooted.

SUMMER TRAINING: (October, 1959 to March, 1960). Sunday: 15 miles barefooted on beach as in winter. Monday: 6x1 mile in 5:00. Jog 300 yards after each. Tuesday and Thursday: 6x3/4 mile in 3:15. Jog 300 yards after each. Wednesday: 20x440 yards in 70. Jog 50 yards after each. Friday: Rest if competition is scheduled for Saturday. Otherwise, repeat Wednesday's training. Saturday: Race.

Throughout this period during noon lunch hour, Monday through Friday, Power jogs 4 miles, followed by 10x100 yard sprints with 50 yards recovery jogging after each.

Each workout is followed by 30 pushups. Except for his 15 mile week-end runs on the beach, Power normally confines his training to 30 minutes during the noon lunch hour and one hour each evening, starting at 5:00 PM. He recognizes no "off-season" from running. His winter training starts in April, while his competitive season starts in October and ends in March.

Power is self-coached, although he receives advice and inspiration from both Jack Pross and Percy Cerutty. He participates in approximately 12 cross-country races and 16-20 outdoor track races annually. He last eats 4 hours prior to racing.

Power uses weight training every second day during the first and second months of his winter training program only, doing 2 sets of 6-12 repetitions of curls, and lifts and squats, starting with 50 lbs., (23kg) and gradually increasing to 120 lbs. (54 kg).

While Power leads most of his races from gun to finish he nevertheless does not use prearranged tactics normally. He prefers to wait and see how the race develops, and act accordingly. In the case of a known fast finisher, he makes every effort to "run him into the ground early" with a killing pace.

His training advice to others is: "To get faster one must get stronger. Therefore by resistence training, e.g. running up hills, one gets stronger and of course his speed improves."

Holder of numerous Australian records, Power won both the 6 miles and marathon titles at the 1958 British Empire Games at Cardiff, Wales. He finished 5th in the 5000m and 3rd in the 10,000m at the 1960 Olympic Games in Rome.

Warming Up for the Sprint Start

by Bish McWatt, New Zealand

(The results in this article were gained by using an electric clock. The clock was set going by the completion of an electric circuit activated by the starting pistol. A light cord was attached to the sprinter and placed so that it ran out unhindered for about 45 feet. The clock was stopped when the electric circuit was broken by the displacement of a small metal tab attached to the other end of the cord when the cord had run out 45 feet. The clock was calibrated in hundreths of seconds but owing to difficulties in setting it accurately to absolute time, the results here can be considered comparative times only, but for the purpose of the experiment this does not invalidate conclusions. It can be seen that as much human error as possible has been eliminated in timing. It would have been better if an electric eye had been used at 45' but costs prevented this. The machine was devised and built by a local coach, Jack Cameron, using funds of the Auckland Athletic Coaches Club.)

Do sprinters warm up enough? I doubt it. I have had the necessity of warm up starts before a sprint race brought home to me recently when I did some work with an electric clock built by a local coach. I gave a sprinter his usual warm up, then put him on the blocks to do some flat out sprint starts over 45 feet. This is the distance than Bunn gives in his "Scientific Principles of Cocaching" as about sufficient to generate near top speed, and it is the first 45 feet that are the most critical in a sprint race provided that the sprinter is fully fit. The following times are not absolute, but they are comparative.

START NO.	TIME TO 1/100THS OF SECOND.
1.	2.36
2.	2.37
3.	2.32
4.	2.29
5.	2.34
6.	2.31
7.	2.29
8.	2.23
9.	2.25
10.	2.27
11.	2.20
12.	2.16
13.	2.16
14.	2.26
15.	2.26
16.	2.26

It will be noticed that not until the 12th-13th start did the athlete register his fasted times. After that, signs of fatigue, or perhaps decline of concentration begins to show up. The lapse of time between each start was as long as fit took the athlete to walk back, for me to wind up the cord, reset the clock, and record the time - probably 23 minutes.

This sprinter actually gained just over two-tenths of a second. What his gain in distance was I cannot say, as this is a period of rapid acceleration, and I have no means of measuring this. But it must represent 1-2 yards for the athlete.

As a result I gave this athlete instructions to take at least a dozen starts flat out over 15-20 yds. before his next club race. The results were pleasing. He turned in his fastest times over 50 yds. and 100 yds. and found himself well clear of his rivals in the first half of each race something he had not been able to do before.

I do not claim that twelve starts in the magic number for all athletes, for each one has his own type of warm up and physically reacts differently to it. I do remember a story -- how true I am not sure - of Mel Patton before the 1948 Olympic 100 meter final, doing 30 flat out starts before the race. He was favorite to win but was last but one. He said that he took just too many starts

Practical Ratios for Triple Jumpers

From a number of world class triple jumpers who have jumped over 53' the percentages of each phase of triple jump from the best broad jump performance are as follows:

Technique	Hop	Step	Jump	Total	Average for each phase
The long hop type (U.S.S.R.)	84.81	64.89	69.05	218.75	72.91
The "flat" type (Schmidt's technique)	76.06	65.45	77.98	219.49	73.16

As most of the triple jumpers probably score a little below their maximum ability in long jump it would be safe to take an average of 75% per phase as reasonable. This means for example that a 20 ft. long jumper should reach 75% from 3 x 20 ft. or 45 ft. in triple jump.

The averages from Schmidt's (30 jumps) and Einarsson (8 jumps) give a following percentage for each phase from the total distance (measured toe - toe - heels):

	Hop	Step	Jump
Schmidt	34.7	29.8	35.5
Einarsson	34.3	30.4	35.3

From these figures it will be safe to take a 35% hop, 30% step and 35% jump as an average economical distribution for the "flat" technique.

Combining the two tables we could now give a new table with distances that should be reached by triple jumpers according to their long jump abilities and how the distances should be reached on the "flat" technique:

Best Long Jump	Hop (35%)	Step (30%)	Jump (35%)	Total Distance
18'	14'2"	12'12"	14'2"	40'6"
19'	15'	12'9"	15'	42'9"
20'	15'9"	13'6"	15'9"	45'
21'	16'6"	14'2"	16'6"	47'3"
22'	17'4"	14'10"	17'4"	49'6"
23'	18'2"	15'5"	18'2"	51'9"
24'	18'10"	16'4"	18'10"	54'
24'6"	19'3½"	16'6½"	19'3½"	55'1½"
25'	19'9"	16'8"	19'9"	56'2"

(The above was translated and extracted by Jess Jarver of Adelaide, Australia from an article by Toni Nett of Germany titled "Economy in triple jumps," which appeared in the No. 23 June 6, 1961 issuedof Die Lehre der Leichtathletik, published in Berlin.)

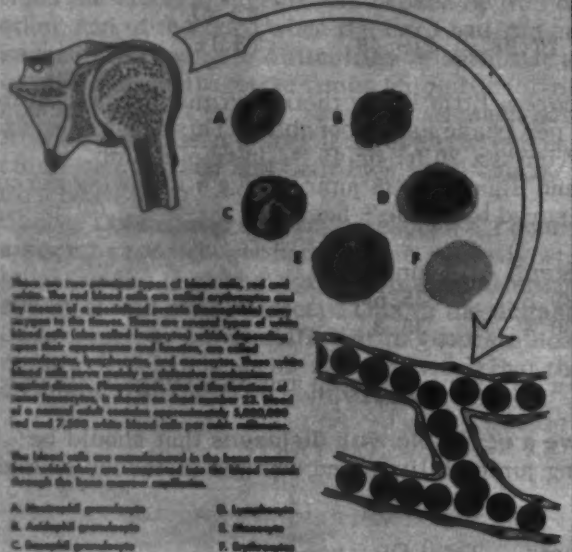
"We run because we like it
Through the broad bright land." - Sorley.

This to my mind illustrates the importance of finding out the optimum number for each athlete, and emphasizes for the dash man the importance of this phase of his warm up.

(Slightly altered from the original article which appeared in the Monthly Bulletin of the New Zealand Amateur Athletic Coaches Association - January 1960.)

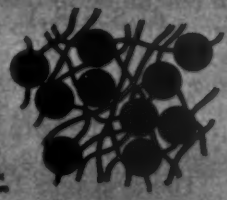
BLOOD

Production of Blood

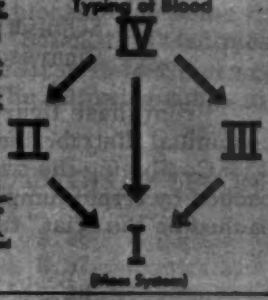


A. Neutrophil granulocyte
B. Acidophil granulocyte
C. Basophil granulocyte
D. Lymphocyte
E. Monocyte
F. Erythrocyte

Clotting of Blood



Typing of Blood



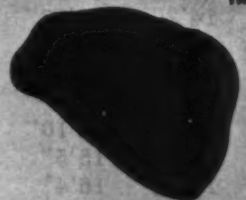
(Moss System)

Chemistry of Blood

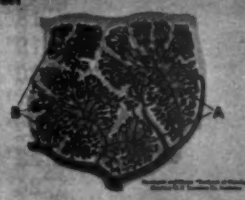
Whole blood is composed of cells and a liquid called plasma. Plasma contains 90% water (blue), 0.9% salt (green), and 4.9% protein (yellow) as related to the whole blood. The cells contain 27% water (blue), 0.9% salt (green), and 17.5% hemoglobin and other proteins (red) as related to the whole blood.

Venous blood carries approximately 10% oxygen (red) and 52% carbon dioxide (blue) while arterial blood carries 27% oxygen and 73% carbon dioxide.

The Spleen



The spleen is an important organ in the circulation of blood. Among its functions are the storage of blood, disposal of old blood cells, and the production of lymphocytes.



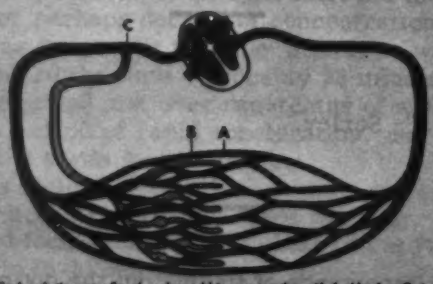
Diagrammatic cross section of the spleen showing the production centers of lymph cycles (A) and the sinuses where blood is stored (B).

LYMPH

Lymphatics

This is a typical distribution of the lymph vessels in one region of the body.
(A) Lymph vessel, (B) Lymph node.

Production of Lymph



The lymphatic system (lymph and vessels) insures, together with the blood capillaries even distribution of liquid in the tissues. In addition it assists the circulatory system in the transportation of food and waste.
Lymph is a fluid which is filtered out into the tissues from the blood capillaries (A). This is then collected into lymph vessels (B) and other passing through several lymph nodes finally flows into the large veins (C).

A Lymph Node

As lymph flows through the lymphatic system it is filtered through lymph nodes. These nodes remove bacteria and other foreign particles from the lymph. The diagram above shows the route through which the lymph is filtered. Arrows indicate direction of flow.